

**REMARKS/ARGUMENTS**

In response to the subject Office Action, a first Amendment to Specifications and to the Claims section is herein submitted.

Examiner Nguyen is thanked for thoroughly reviewing the above referenced patent application, and for the indication of allowability once various formal matters and informalities are corrected.

**General Remarks  
on Claim Objections and Claim Rejections due to 35 USC §112**

Some terms used in the Patent Application obviously led room for misunderstanding. Especially the terms "steady" and "continuous" or "continually": these terms are meant in the pure mathematical sense of "steady change" or "continual change", as being free of jumps or breaks. Applicant apologizes for not distinctly pointing out these terms in an unambiguous way in the presented patent application.

Differing from an ideal switch, a real semiconductor switch has an analog transition phase; in normal switching application, such analog transition is an unwanted effect and circuit designers try to eliminate it. However, as presented in related patent application US Serial No. 10/764920, filed Jan. 26, 2004, a fundamental aspect of the invention therein is to use the sliding analog transition of the series resistance  $R_{DSon}$  (from near

infinity to near zero) in a carefully controlled way to achieve the partial and sliding switching of the small capacitors. Patent application US Serial No. 10/764920 is the general basis for the instant application. The key invention of the instant application itself is the replacement of the operational amplifiers, as presented in one of the solutions of patent application US Serial No. 10/764920, with translinear amplifiers.

In the present amendment to the instant application, the technical fundamentals are now expressed in several new paragraphs in the specification. These fundamentals were largely taken from related patent application, US Serial Number 10/764920, filed on January 26, 2004, which was incorporated by reference into the instant application in the Summary of the Invention, at page 4 and in Description of the Preferred Embodiment at page 14.

The definition of fundamental technical terms are improved and then used throughout the document. As a consequence, many paragraphs and claims had to be amended, to reflect these improved term-definitions. The consistent use of the newly defined terms should eliminate the majority of reasons for the claim rejections listed by the examiner. No new matter has been added.

Further, it is now made clear, that the "set of circuits to linearly control the switching function operation" contains, besides possibly other components the set of translinear amplifiers.

Many other changes throughout the document should cure the criticized inconsistencies.

Concerning the "Additional circuit elements, implementing a signal-limiting function" additional information is provided, especially describing the mechanism to sharply cut off said translinear amplifier's linear operation, once the defined linear operating range is exceeded:

The implementation of said signal limiting function itself is part of the invention of related patent application US Serial No. 10/676919, filed Oct. 1, 2003; details of the implementation are presented in the referenced application, Serial No. 10/676919 (in the specification and in Fig. 7). The original document of the instant application, referenced said "Additional circuit elements, implementing a signal-limiting function" on page 6, first paragraph, saying:

"Additional circuit elements, described in the related patent application, Serial No. 10/676919, implementing a signal-limiting function, drive said switching transistor either into its fully-on state ( $R_{DSon}$  going to 0) or drive it into its fully-off state ( $R_{DSoff}$  going very high) when said switching device is outside its dedicated active working area."

The additional information is largely taken from the referenced application, Serial No. 10/676919. Especially the first paragraph on page 6 and the second paragraph on page 15 are amended with improved specification.

**General Remarks / Arguments  
on Claim Rejections due to 35 USC §102 and § 103**

Applicant respectfully disagrees that Liu shows "a circuit to control the capacitance of a variable capacitor in a linear mode through a steady tuning voltage to achieve (....) comprising a set of small capacitors and a set of switches that is turned on/off depending on the control signals, translinear amplifiers, (....)."

Liu actually teaches the concept of a switched capacitor chain, where capacitors are digitally switched in parallel one after the other, thus increasing the capacitance step by step, very similar to the circuit and method Applicant has mentioned as Prior Art and shown in **Fig. 2a** and **2b**.

Liu explains: "The comparison circuit 50 is an analog-to-digital converter for converting the signals from the voltage dividing circuit 40 into digital signals to control the correction circuit 60."

Further, Liu teaches, that the comparison circuit contains (digital) comparators,

Liu does not implement operational amplifiers in the comparison circuit 50, neither does Liu implement translinear amplifiers anywhere in the referenced patent.

In addition, the description of Fig. 5 clearly explains:

- "If the comparator connecting to a node causes the corresponding switch S to be closed and the correction circuit unit 65 is electrically connected in parallel with the

capacitor  $C_f$ , the corresponding switch  $S$  is labeled "ON".

- "If the comparator connecting to a node causes the corresponding switch  $S$  to be open and the correction circuit unit 65 is electrically disconnected from being in parallel with the capacitor  $C_f$ , the corresponding switch  $S$  is labeled "OFF".

i.e. switching the capacitors is performed in a digital mode, step by step.

Even further, Liu explains: "Each of these correction circuit units 65 comprises a transistor  $S$  to serve as a switch, and a correction capacitor  $\Delta C$ . The ON and OFF state of each transistor  $S$  is controlled by the output of the corresponding comparator in the comparison circuit 50."

Liu explicitly shows a digital ON/OFF-status diagram in FIG. 5 the status of "each correction circuit unit" (the switch) "to be changing to ON or OFF."

Concerning the digital switch, please see also Claims 11 and 13 of Liu (US Pat. 6,577,180).

Based on the cited content of Liu's Patent, Liu does not show a partially switched on device with an analog ramp-up/ramp-down operation in his patent; the switch is always either fully switched on or fully switched off in a pure digital manner.

In comparison, Applicant claims (in claim 1.):

A circuit to control the capacitance of a variable capacitor in a strictly linear mode through a steady tuning voltage and to achieve a high Q-factor at the same time; comprising:

a set of individual small capacitors;

a set of switching devices, allowing a steady ramp-up/ramp-down phase between the points of being fully switched on and fully switched off, and where said switching devices are connected in series with said capacitors of said set of capacitors, to connect a multiple of said capacitors in parallel;

a set of circuits to control the switching operation in a ramp-up/ramp-down manner between the points of being fully switched on and fully switched off, provided to each of said set of switching devices;

a set of translinear amplifier stages to produce the ramp-up/ramp-down signal for each of said set of switching devices and implemented within said set of circuits to control the switching operation;

a circuit to individually provide the threshold points for each individual capacitor switching stage; and

a circuit to provide a signal, dependent on the tuning voltage, dedicated for the voltage controlled capacitance change, to all of said translinear amplifier stages.

Primarily applicant claims:

1. the use of a switch with a steady ramp-up/ramp-down phase, to partially switch (between 0 % and 100 %) a capacitor in parallel to other capacitors of a set of capacitors. (presented in patent application US Serial No. 10/764920), which is the fundament of the instant application).
2. the use of a translinear amplifier to provide the (analog) control signal to the continually switching device to steadily switch on a capacitor from 0 to 100 % and providing circuits and methods to carefully control the overlapping operation of multiple "switching devices, each with a steady transition phase".

Regarding the implementation of a "set of small capacitors", such capacitors may be implemented as integrated capacitors on the same semiconductor chip as the "set of circuits to control the switching operation"; it may however be implemented also on a separate carrier as a multi-capacitor arrangement or it may even be implemented as individual components. The presented patent application is not limited to a specific implementation of a set of capacitors.

***Detail Remarks/Arguments on Claim Objections***

Reconsideration of the objection of claim 10, because of certain informalities, is requested, based on the following.

The term "the output reference signal" in claim 10 is replaced by the term "the output reference level", as used in other places in the instant application.

Reconsideration of the objection of claim 31, because "said set of reference value" does not have antecedent basis, is requested, based on the following.

The word "said" is eliminated.

Reconsideration of the objection of claim 8 is requested, based on the following.

It is an inherent characteristic of translinear amplifiers to have a gain of 1. Only when special measures are taken, a different gain is achievable. See related patent application US Serial No. 10/676919, filed Oct. 1, 2003, for an explanation of the characteristic of translinear amplifiers.

***Detail Remarks/Arguments on Claim Rejections - 35 USC § 112***

Reconsideration of the rejection of claims 1-52 as being indefinite is requested, based on the following.

Correction and/or clarification is provided, as generally explained before.

Regarding claim 1, 17, 26, 29, 33, 43, 47 and 50 the recitation "means for a." is replaced by "a circuit " and the term "continuous switching" is replaced with the term "steady ramp-up/ramp-down switching" or "steady transition phase". Further explanation is provided citing the fundamentals of related application US Serial No. 10/764920, filed Jan. 26, 2004.

Regarding claims 18 and 19, the term "outside its dedicated active working area" is replaced by "desired steady transition area" and further explanation is provided.

Regarding claims 20 and 21, further explanation is provided in the specification for the recitation of the "signal-limiting function". In addition, the specification explains that the circuit to implement said "signal-limiting function" might be part of the translinear amplifier, as demonstrated in the related application US Serial No. 10/676919, filed Oct. 1, 2003.



Regarding claim 47, it is made clear, that the "set of circuits to control the switching operation in a ramp-up/ramp-down manner, contains, typically besides other components, a set of translinear amplifiers".

***Detail Remarks/Arguments on Claim Rejections - 35 USC § 102***

Reconsideration of the rejection of claims 1-6, 8, 9, 11, 14, 17-21, 23, 24, 29-47 and 50-52 as being anticipated by Liu (US Pat. 6,577,180) is requested, based on the following.

Regarding claim 1, the application of Liu actually teaches the concept of a switched capacitor chain, where capacitors are digitally switched in parallel one after the other

In addition Liu uses (digital) comparators to digitally control the switching devices

In contrast, the related patent application US Serial No. 10/764920 uses operational amplifiers and the instant application uses translinear amplifiers to control the ramp-up/ramp-down operation of the switching devices.

Regarding claim 14, the invention may be used with a set of small capacitors, made in a variety of processes, namely, as discrete components, as (metal-oxide) capacitors on a common planar substrate and as a set of capacitors, integrated on a semiconductor circuit carrier, either the same or a different carrier than the one for the controlling circuit.

Regarding claims 17, Liu clearly states, the capacitors are not switched in a linear mode but are switched digitally step by step. See description of Fig. 5 of Liu.

***Detail Remarks/Arguments on Claim Rejections - 35 USC § 103***

Reconsideration of the rejection of claims 7-9, 12-16, 22, 25 and 40 as being unpatentable over Liu (US Pat. 6,577,180).is requested, based on the following.

Figure 3 of Liu shows a circuit fundamentally different from the instant application, as Liu does not implement a linear ramp-up-ramp-down operation of the switching device to achieve a sliding (0% to 100%) parallel connection of the small capacitors. Liu implements (digital) comparators in contrast to the translinear amplifiers of the instant application.

Reconsideration of the above rejection (or objection) is therefore respectfully requested.

All claims are now believed to be in condition for allowance, and allowance is so requested.

It is requested that should there be any problems with this Amendment, please call the undersigned Attorney at (845) 452-5863.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'S. B. Ackerman', with a large, stylized 'A' at the end.

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